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James (Jim) Sudworth 1939–2013



In the untimely death of Jim Sudworth the international battery community has lost a leading figure. Jim was a Lancastrian, born and raised at Ashton-in-Makerfield, near Wigan. He left school at age 16 and took a job as junior laboratory technician at ICI, Widnes. He studied chemistry by day-release at Widnes Technical College to obtain graduate membership of the Royal Institute of Chemistry (now the Royal Society of Chemistry). By general consent this was a hard road to qualification. In 1965 he joined the Chloride battery group and worked for two years for the well known battery scientist Ken Peters.

In 1966 the Ford Motor Company in USA announced the discovery of beta alumina as a solid ceramic electrolyte that conducts sodium ions at elevated temperature. Two of their scientists showed how, in principle, a high temperature sodium/sulfur cell could be based on this electrolyte. Ford's interest lay in a traction battery for electric cars. About the same time in the UK British Rail was

establishing a new research centre at Derby and was interested in this novel battery for use in railway locomotives. Jim applied for a job there and joined a new team set up to develop the Na/S battery. Another UK player in the game was the Electricity Council at Capenhurst which also started to investigate the battery for energy storage in the electricity supply network and, together with the Chloride Group, formed a subsidiary company Chloride Silent Power based at Runcorn, Cheshire.

On realising the widespread interest in this technology and its potential applications, the UK Government's Department of Trade and Industry in 1972/3 commissioned a year-long Project Definition Study at its Harwell Laboratory. The outcome of this study was that all three centres (Derby, Runcorn and Harwell) collaborated in a national project to develop the Na/S battery and this co-operation continued for many years. Jim Sudworth led the B.R. team of scientists and engineers. Considerable success was achieved and several electric vehicles propelled by Na/S batteries were demonstrated. Ultimately, though, the project was terminated by the end of government funding and by the decision by B.R. to withdraw. The core of the B.R. team, who were wedded to the project, decided to establish an independent operation and to seek sponsorship elsewhere. The management of B.R. gave them generous support in the form of laboratory space and equipment.

Meanwhile, Harwell had begun contract research for the De Beers/Anglo American Corporation aimed at developing another sodium battery concept, originated at CSIR South Africa, utilising an iron chloride positive electrode. For this initial study, Jim and his team kindly supplied Harwell with cell components and expertise. This initial study proved promising. In order to expand the work beyond Harwell's capabilities and available staffing levels, Anglo American involved Jim's team directly, providing substantial funding and forming a new company, Beta R and D.

There followed a period of several fruitful years collaboration between Beta R&D, CSIR and Harwell in which most of the scientific problems were overcome and the technology developed. An early breakthrough was to assemble the cell in the discharged state which circumvented the need to prepare and handle anhydrous NiCl_2 and metallic sodium. The cell was based on a beta alumina tubular electrolyte and the active components were simply a blend of metallic nickel and common salt (NaCl), together with sodium chloraluminate NaAlCl_4 as a liquid ionic

conductor. The sodium negative electrode and the NiCl_2 positive were formed in situ during the initial charge. A pilot production line for cells and batteries was set up in Derby and electric vehicles operated in the city. Crucially, the safety of the battery was demonstrated.

Anglo American then went into partnership with the German company AEG and batteries were built both at Derby and in Germany for a range of Mercedes electric cars. These were subjected to extended trials, mostly in Germany.

At the end of this phase of the work AEG/Mercedes decided to focus its efforts on fuel cells and withdrew from the project. This was a great disappointment for the South Africans who concluded that they were unable to continue as sole funding agency for the venture and so also withdrew. At this point Beta R&D was again facing an uncertain future. Led by Sudworth they succeeded in persuading a Swiss automotive company, MES-DEA, to take on the technology and build a larger pilot production line for traction batteries in Switzerland. Since then MES-DEA has gone into partnership with FIAMM Batteries and has formed a joint subsidiary (FZ Sonick SA) to scale-up production to commercial levels. They have adopted the brand name ZEBRA for the batteries, a code name that originated at Harwell as long ago as 1980.

By its agreement with MES-DEA, Beta R&D was left unencumbered to pursue in Derby other avenues and applications for sodium batteries. This they did successfully. The final phase of the saga (to date) is that the US General Electric company in 2007 bought out Beta R&D and has since established an entirely new factory in Schenectady, New York to build these sodium batteries on a commercial scale under the brand name DURATHON. The application they are focussing on initially is electricity storage for telecommunications facilities in remote,

tropical locations, especially in Africa. There is a certain irony here in that much of the commercial drive for this battery originated in South Africa and yet it took the G.E. company, with its broader range of activities, to identify this market opportunity. In the longer term G.E. also envisages traction applications, especially for locomotives—which is where British Rail started out.

Jim Sudworth was a versatile person who was equally at home writing and presenting scientific papers, grappling with intricate materials science and engineering problems, and designing and commissioning pilot plants. Although quiet and unassuming in nature, he was a born leader and entrepreneur. In addition to his vision he had a dedicated single-mindedness of purpose. This has paid off and there are now manufacturing plants for sodium–nickel chloride batteries in Switzerland and USA as well as the pilot plant in Derbyshire. One day soon these batteries will be widely used around the world for many different applications where their technical characteristics and inherent safety make them uniquely suitable. This progress is thanks largely to Jim's leadership, drive and dedication. On a personal level he was comfortable dealing with associates at all levels and was always kind and fair in his dealings. Even at age 74 he was still working enthusiastically, motivated always by technical challenges. In his sudden death the battery world has lost a pioneer and very many people have lost a true friend and colleague. Our deepest sympathies go out to his wife, Sheila, and to their extended family.

Ronald Dell

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